GEOLOGY AND MODEL RAILROADING

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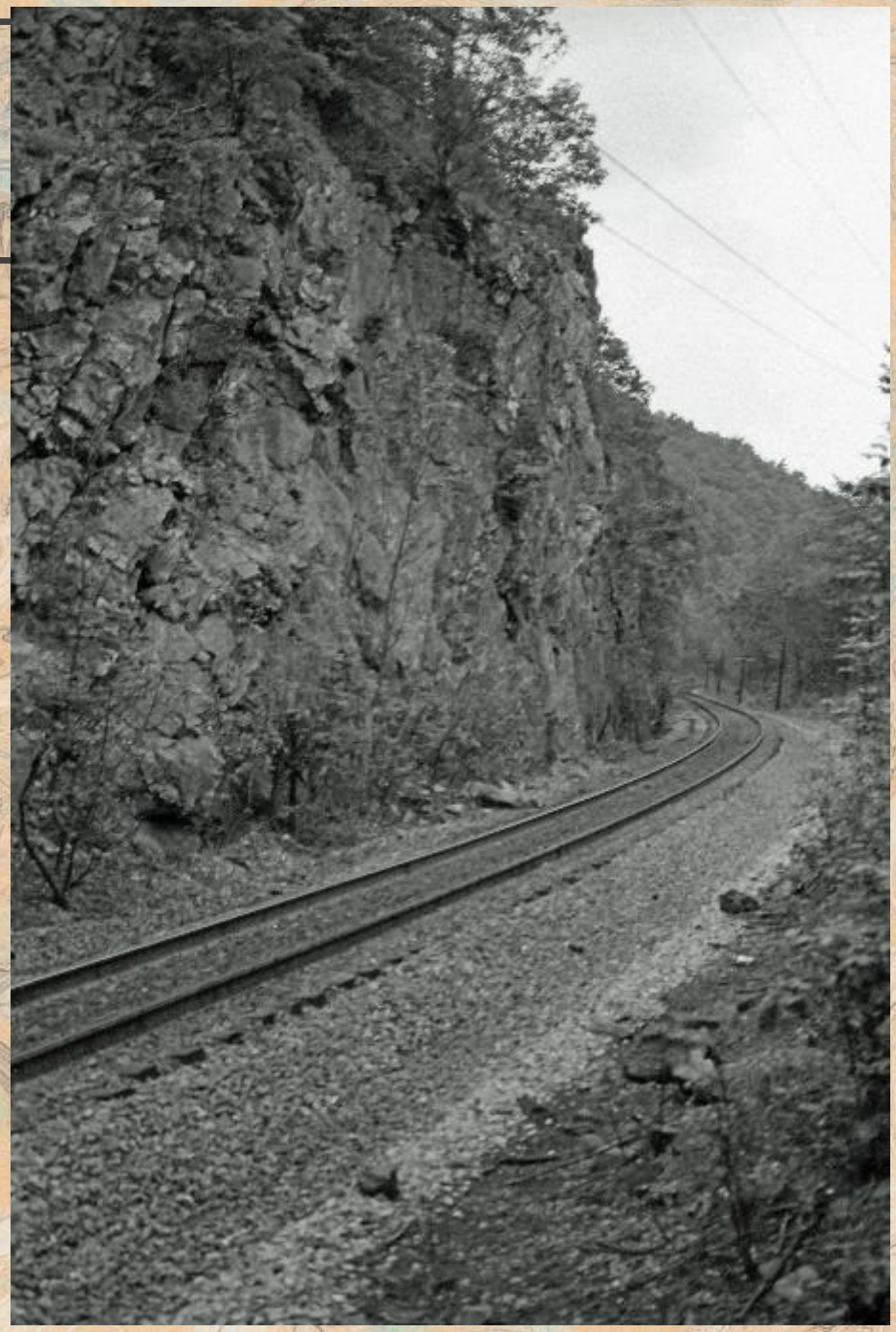
HOW DO RAILROADS INTERFACE WITH GEOLOGY?

- Geology is the study of rocks
- Railroads:
  1. Build on and cut through rocks
  2. Build with rock
     1. Fills across valleys
     2. Structures
     3. Ballast



ROCK OUTCROPS AND ROCK CUTS

- Granite: cooled underground from a magma
- Coarse grained (visible mineral crystals)
- Strong and durable
- Natural outcrop (along the top) in southern Missouri
  - Rounded surfaces from long term weathering
- Boulders and smaller blocks
  - Angular with rough surfaces

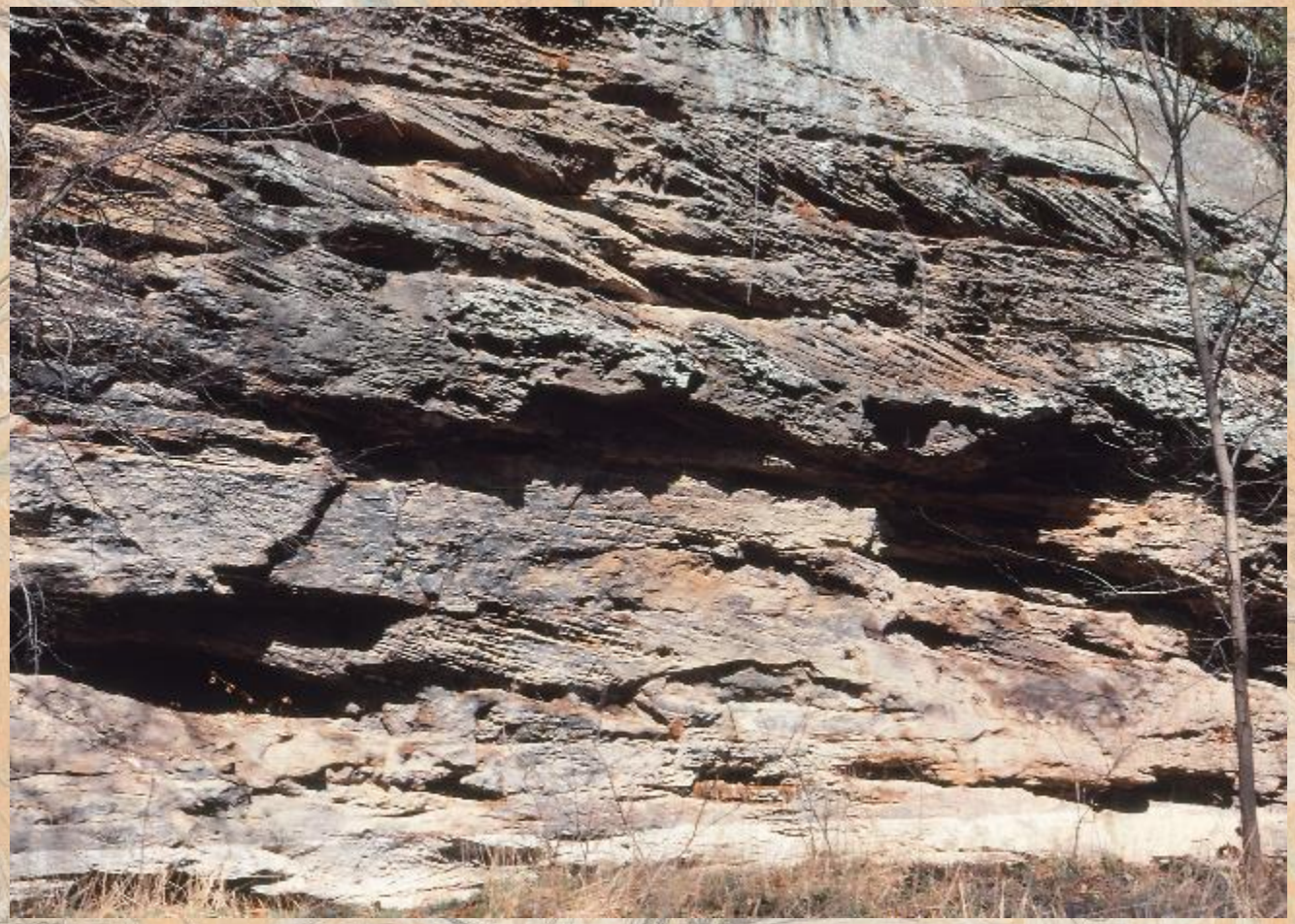
ROCK OUTCROPS AND ROCK CUTS

- Examine the red to pink rocks
- Rhyolite: cooled above ground from lava
- Fine grained (very few visible crystals)
- Strong and durable
- El Paso, Texas natural outcrop

ROCK OUTCROPS AND ROCK CUTS

- Tuff: volcanic ash
- Cooled from a lava above the ground surface
- Weak with some strong layers
- Durability is variable
- Bandelier National Monument
- New Mexico, Colorado
- Natural outcrop
- Wavy fracture pattern

ROCK OUTCROPS AND ROCK CUTS



- Sandstone: Sand grains that are "glued" together with other minerals
- Strength and durability depends on the type and quantity of the matrix mineral (glue)
- Rough grainy surface
- Natural outcrop along the Wabash River in western Indiana
- Layering: horizontal layers of individual beds that are inclined to the horizontal
- Ancient river deposit
- This outcrop: not very hard and not durable

ROCK OUTCROPS AND ROCK CUTS

- Shale: very fine grained, non-visible rock fragments, silt and clay
- Soft and low durability
- Highway cut in Kansas City, Kansas I-635 & I-70
- Thin beds, up to a few inches, horizontal beds
- Delta deposits
- Rills on surface indicate soil formation

ROCK OUTCROPS AND ROCK CUTS

- Limestone: Crystalline sedimentary rock composed of calcite
- Durability and hard
- Massive limestone bed
- Highway cut near Pittsburgh, PA

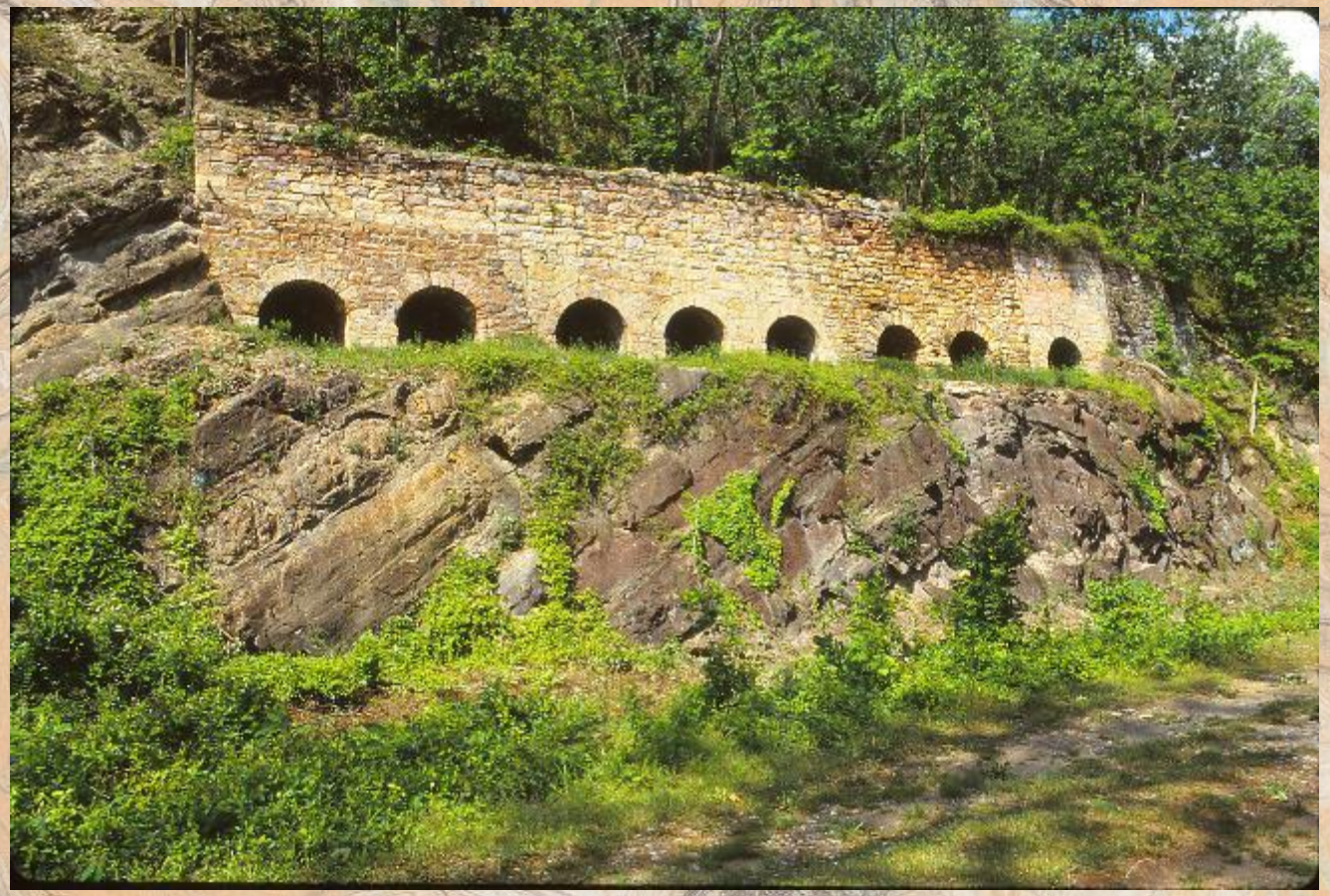
ROCK OUTCROPS AND ROCK CUTS

- Limestone: weathered
- Caves and dissolution along joints
- Highway cut I-435 and MO Rte 152
- Thin wavy lines are shale and clay seams

ROCK OUTCROPS AND ROCK CUTS

- Mixed Outcrop: shale, limestone, and sandstone
- Highway cut in West Virginia
- Horizonal layers typical of the Appalachian Plateau and most of the Midcontinent
- The shale units are weaker and eroding from below the sandstone and limestone
- Slopes in the shale are more gradual
- Boulders of more resistant rocks along the base.

ROCK OUTCROPS AND ROCK CUTS



- Shale and siltstone: Folded sedimentary rocks
- Chesapeake and Ohio Canal in Maryland
- Canal cut
- Structure is a brick kiln
- Folded due to formation of the Appalachian Mountains
- Left side – rocks slope left
  Right side – rocks slope right

ROCK OUTCROPS AND ROCK CUTS

- Schist: dark green to gray with some white seams, mica (flaky mineral), layered, visible grains, wavy texture
- Natural outcrop at Smugglers Notch, Vermont
- Strong and durable
- Lots of joints and fractures forming blocks

ROCK OUTCROPS AND ROCK CUTS

- Marble: White to gray, metamorphosed limestone
- Highway cut near East Dorset, Vermont
- Massive to layered, calcite, wavy bands of other minerals (micas)
- Strong and durable

TERRAIN (BACKDROPS)

- Switzerland
- Alps - Monch
- Kleine-Scheidegg
- Young mountains
- Jagged, irregular crest line, lots of exposed rock
- Taken from the cog railway

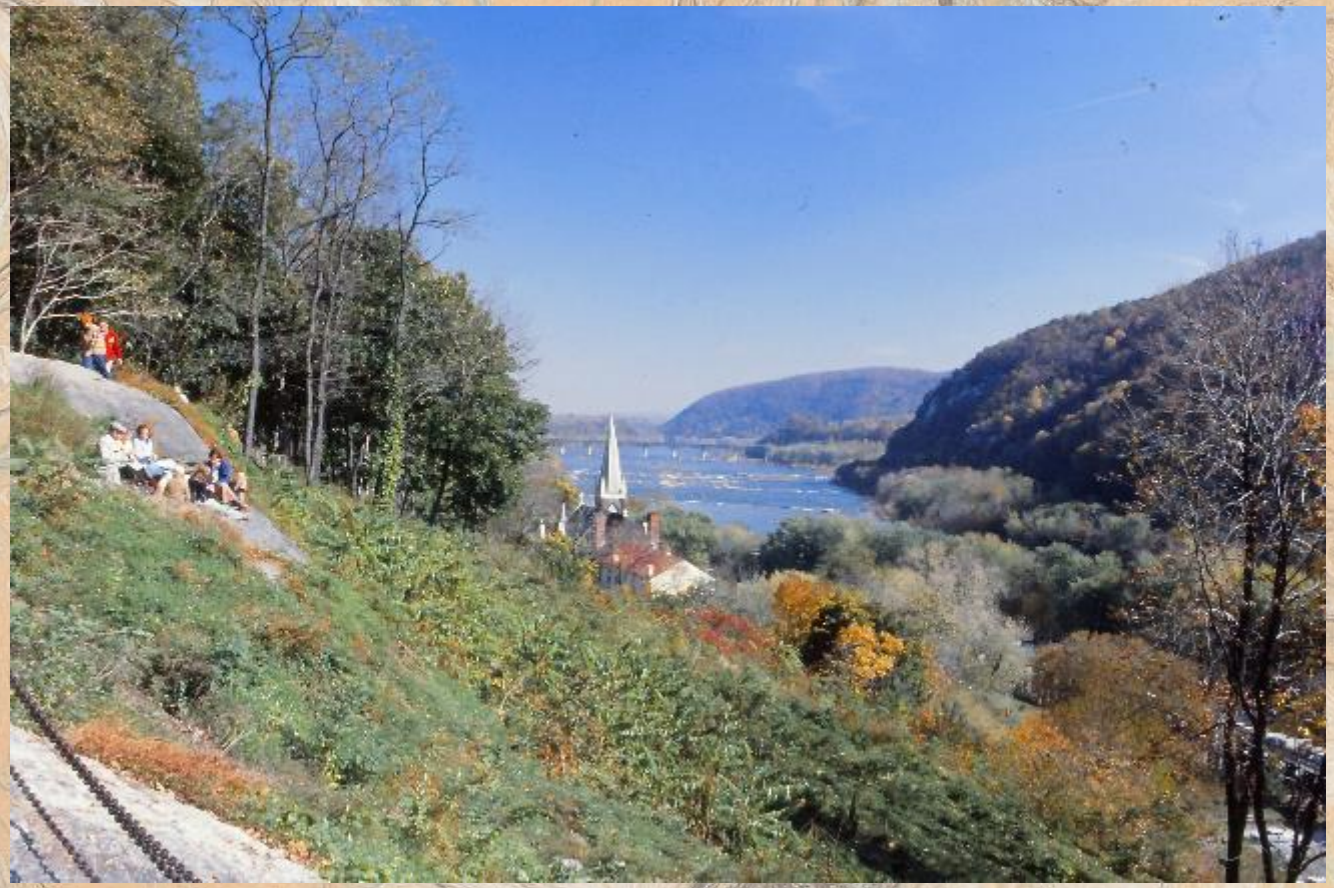
TERRAIN (BACKDROPS)

- Rocky Mountains, Colorado
- Garden of the Gods and Pikes Peak
- Young mountains
- Angular with irregular crest line

TERRAIN (BACKDROPS)

- West Texas
- Franklin Mountains, El Paso
- Young mountains
- Angular with irregular crest line
- Arid vegetation

TERRAIN (BACKDROPS)



- West Virginia
- Harpers Ferry – South Mountain/Blue Ridge
- Older mountains
- Rounded, uniform crest line, less outcrops
- Humid vegetation

TERRAIN (BACKDROPS)

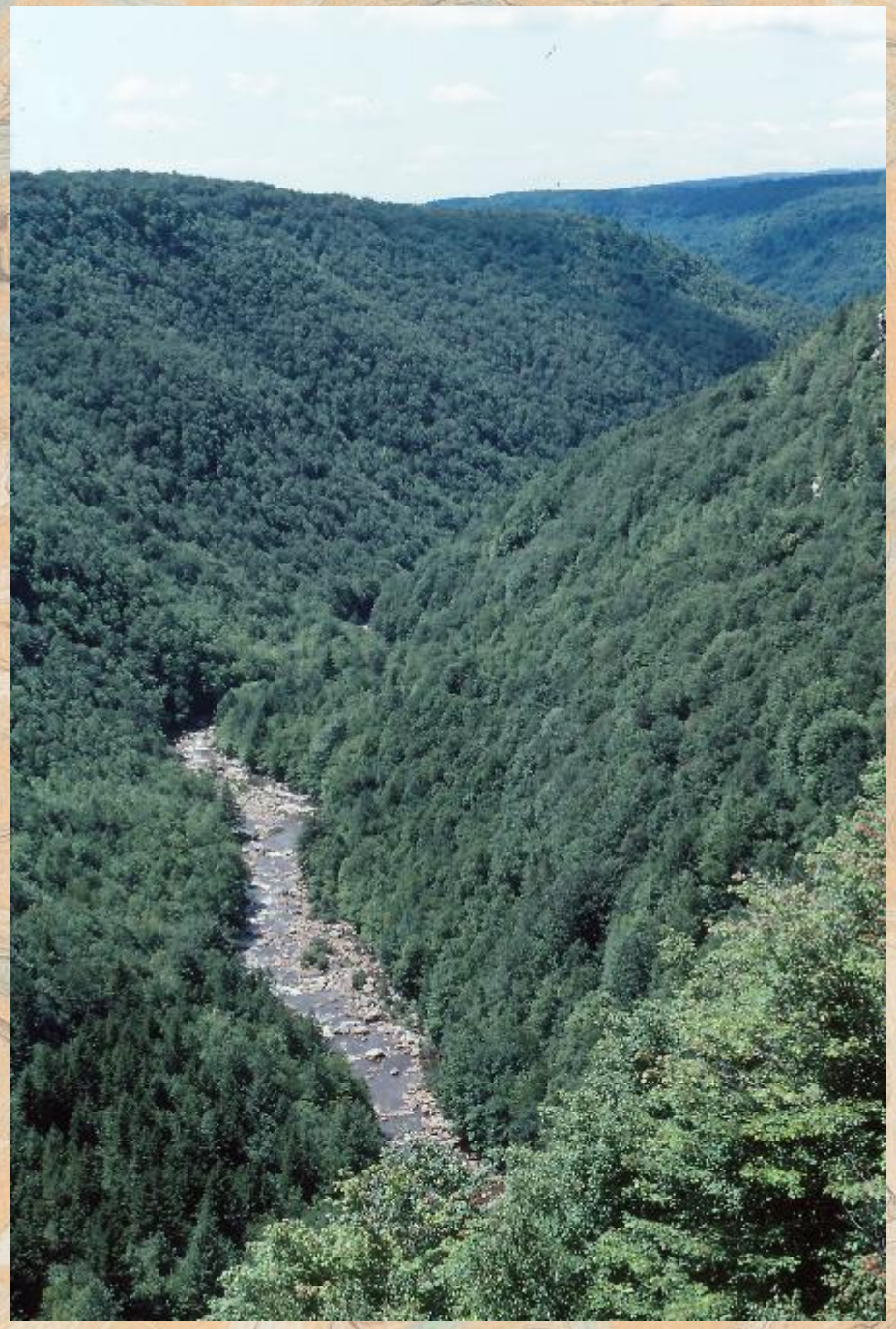
- Pennsylvania
- Appalachian Plateau, southeast of Pittsburgh
- Older mountains
- Rounded with straight crests
- Humid vegetation

TERRAIN (BACKDROPS)

- Kansas
- Clinton Lake, Lawrence
- Midcontinent
- Low bluffs, flat top hills
- Humid vegetation

RIVERS AND STREAMS

- West Virginia
- Blackwater Falls area, east of Morgantown
- Youthful river valley
- V-shaped cross-section
- River occupies the valley floor
- Erosion is deepening the valley
- Lots of rock exposure



RIVERS AND STREAMS

- Germany
- Rhine Valley, Braubach
- Mature valley
- Steep valley walls
- Floodplain
- Erosion is widening the valley
- Sediments instead of rock

RIVERS AND STREAMS

- Mississippi
- Mississippi River in Vicksburg
- Old age valley
- Valley walls are miles apart, Vicksburg is on a bluff
- Floodplain
- Hills are mostly removed
- Sediments

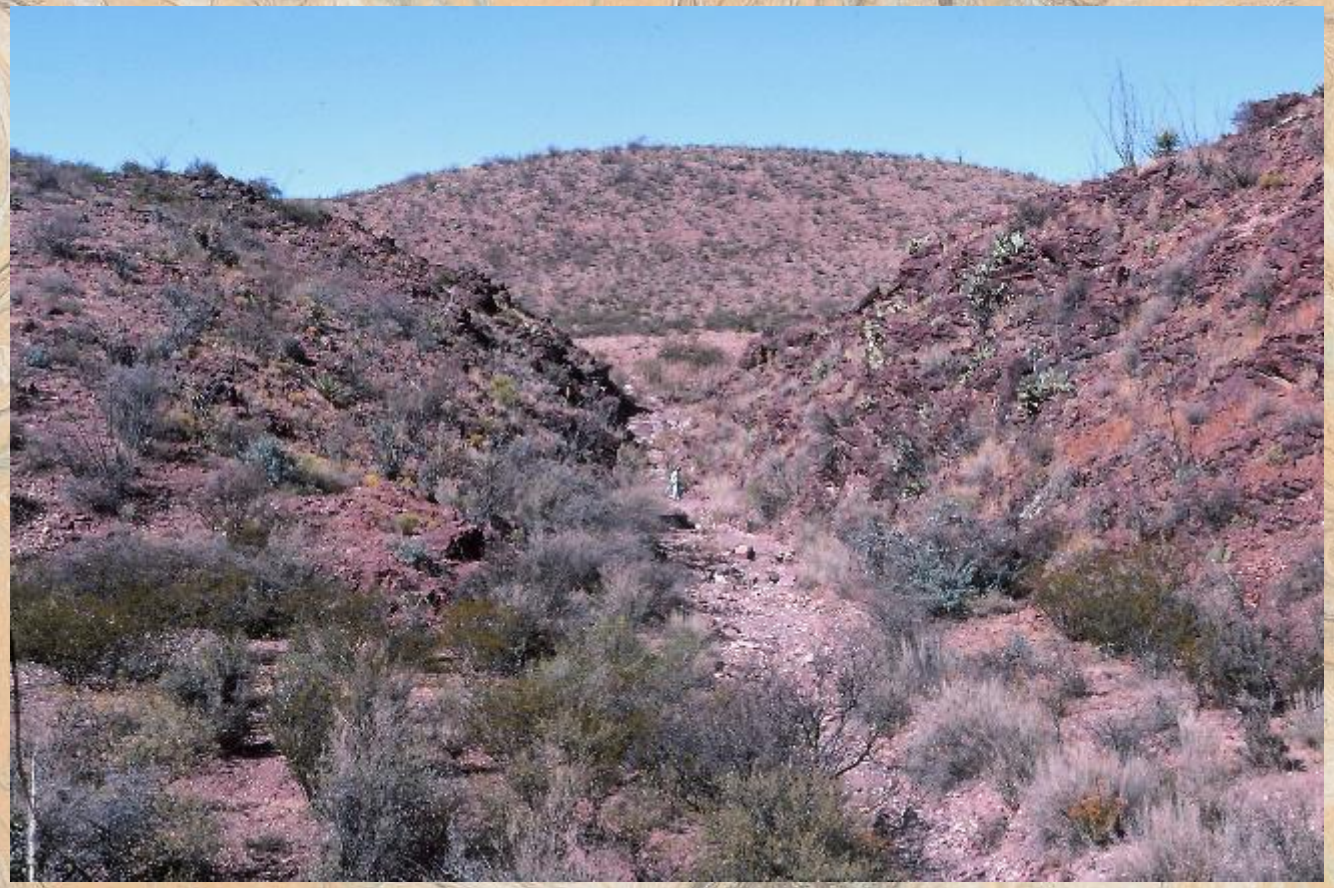
RIVERS AND STREAMS

- West Virginia
- Appalachian Plateau
- Mature river valley with a small stream
- Some small boulders and cobbles
- Quiet water

RIVERS AND STREAMS

- Texas
- Franklin Mountains, El Paso
- Mature river valley with no water
- Meandering
- Sediments: small boulders, cobbles, sand

RIVERS AND STREAMS



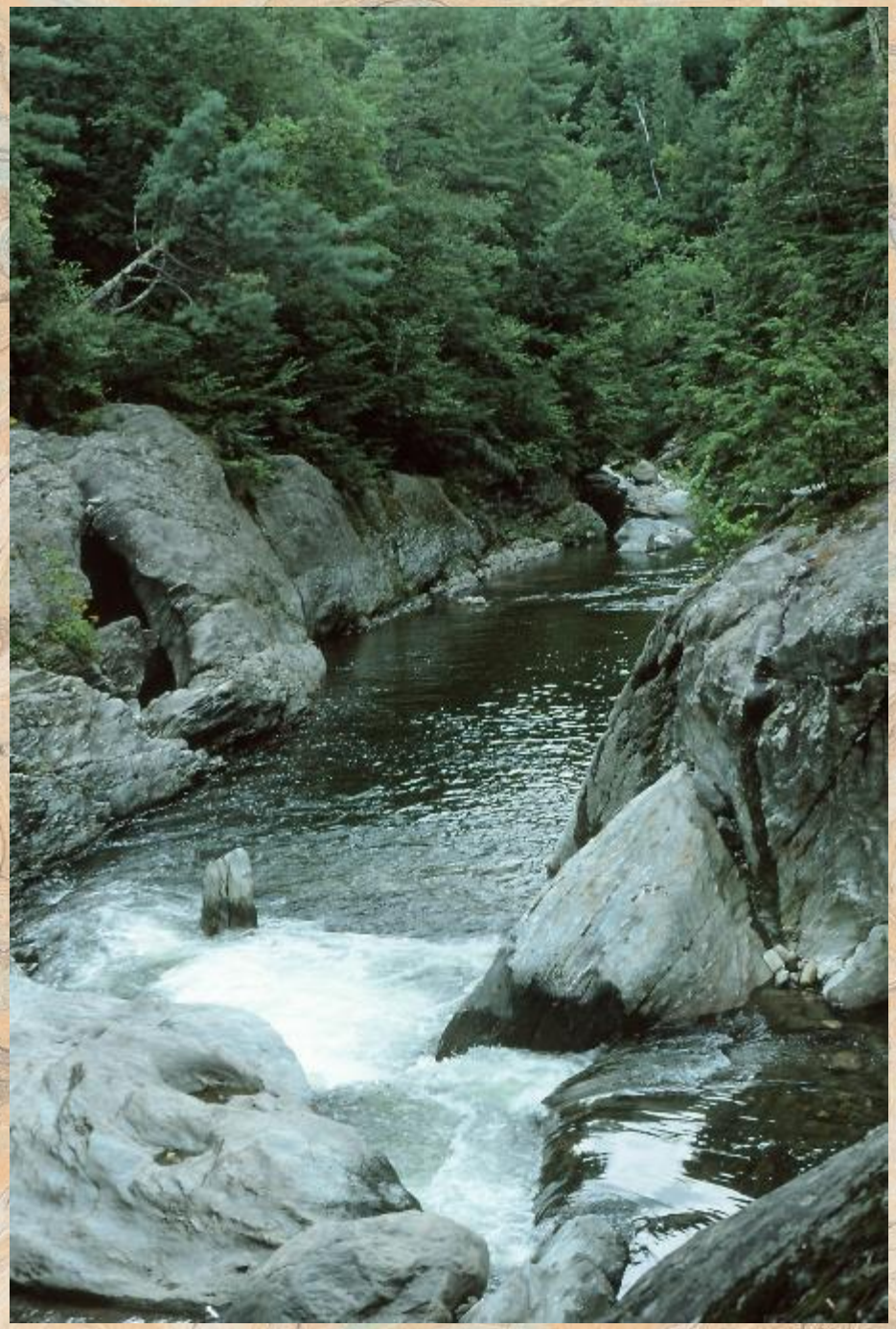
- Texas
- Van Horn
- Arroyo
- Sediments: small boulders, cobbles, sand

RIVERS AND STREAMS

- Virginia
- Valley and Ridge area west of New Market
- Mature river valley with no water
- Sediments: small boulders, cobbles

RIVERS AND STREAMS

- Maryland
- Side channel at Great Falls
- Looking downstream
- Notice the two nearly horizontal areas of water with the waterfall between
- Knickpoint



RIVERS AND STREAMS

- West Virginia
- Blackwater Falls
- River is nearly horizontal above the falls
- Sedimentary rocks

RIVERS AND STREAMS

- Virginia
- Blue Ridge
- Rapids through boulders
- Metamorphic rocks

SINKHOLE

- Kansas
- Near Ashland (southwest Kansas)
- Depression cause by a collapse of a cave
- The failure extends to his pickup
- Sedimentary rocks – more like soil

SINKHOLE

- Kansas
- Near Meade (southwest Kansas)
- Foreground: Little Sink
- Background: another sinkhole below the rock outcrop
- No surface drainage

MASS MOVEMENT

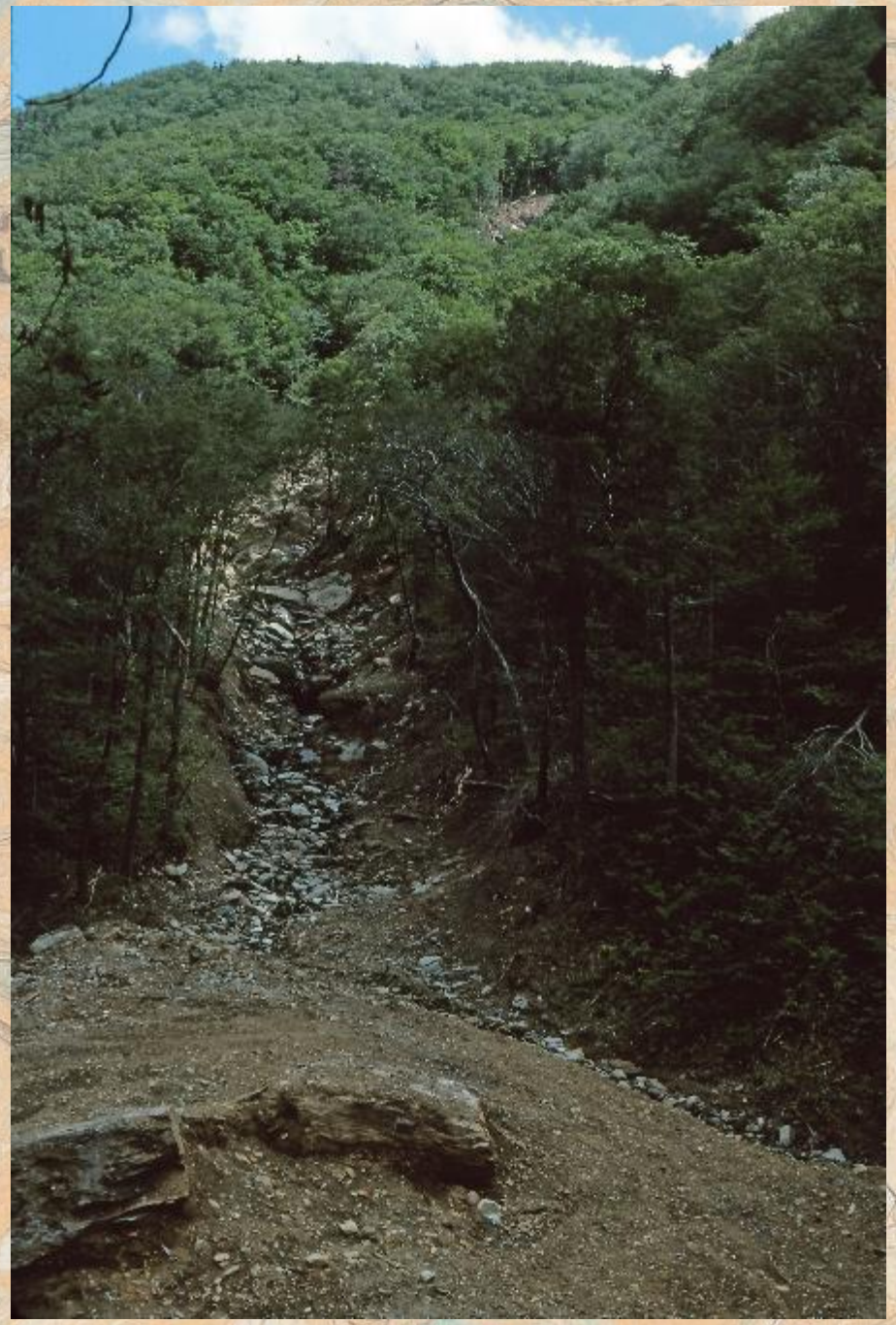
- Vermont
- Smugglers Notch
- Rockfall blocks of rock break free and drop or roll down slope

MASS MOVEMENT

- Vermont
- Wallingford
- Rockslide blocks of rock sliding along planar surfaces in bedrock
- Talus slope

MASS MOVEMENT

- Vermont
- Smugglers Notch
- Debris flow – fluid mix of soil up to boulder size
- Follow channel
- Metamorphic rocks



MASS MOVEMENT

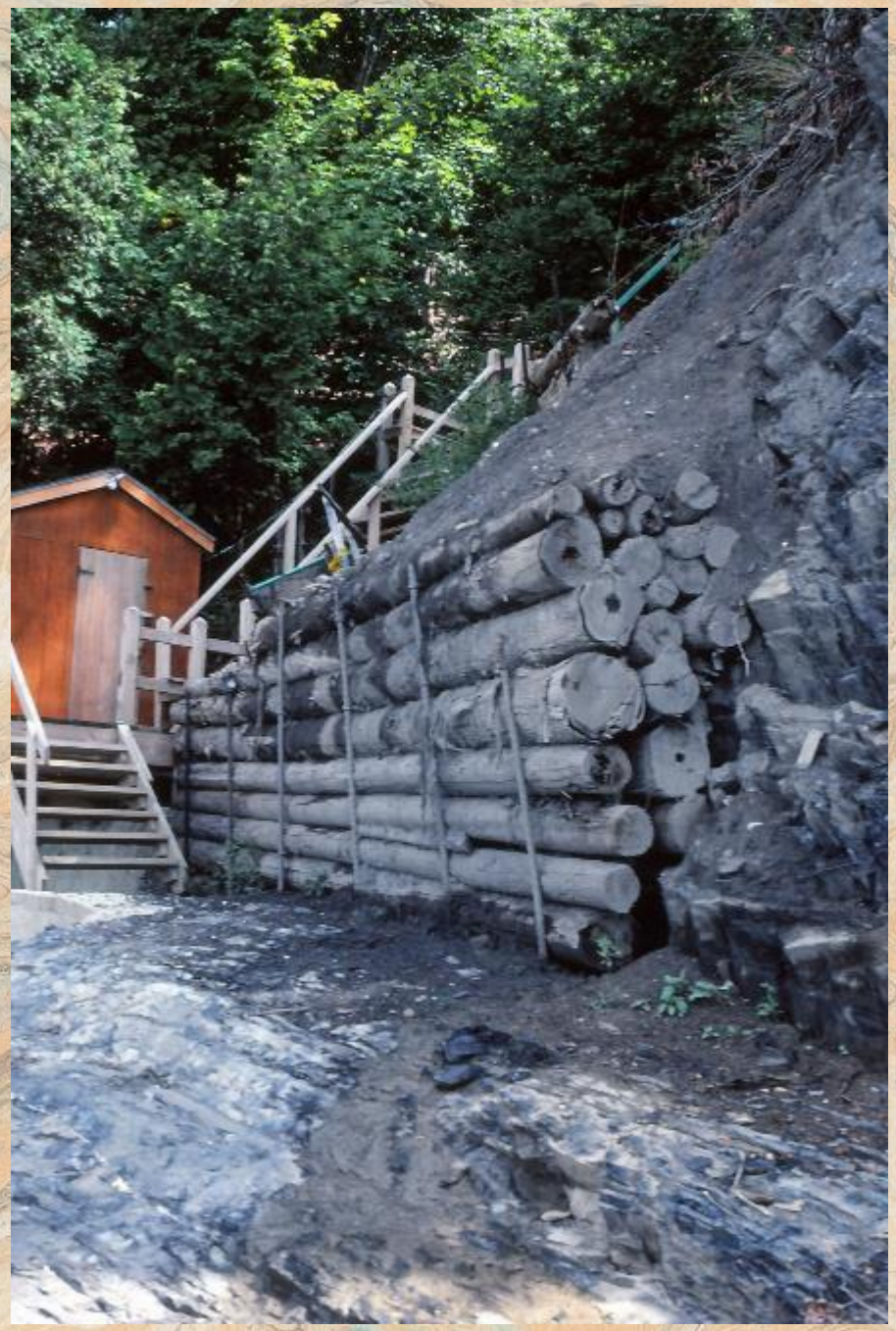
- Vermont
- North Springfield
- Earthflow mix of clay, silt, sand and water
- Zone of internal mixing of material at the base of the failure

MASS MOVEMENT

- West Virginia
- Spencer
- Earthflow with a retaining wall
- Vertical I-beams and concrete cribbing
- The retaining wall is at the top of the slope

MASS MOVEMENT

- Vermont
- Lake Champlain area
- Retaining wall made of logs and rebar
- Some of the rebars are cabled to the top of the slope
- Limestone bedrock
- Hillside is lake sediments



Additional Information: NMRA Data Sheet DS10.8A Soil and Rocks: General